

REMARKS

This Specification and the Abstract have been amended to correct inadvertent spelling errors and to delete the phrase "regardless of alignment" which appears to be unnecessary in explanation of the application as filed.

Claims 1 and 5 have also been amended to delete the phrase "regardless of alignment" which it is believed will overcome the rejection under 35 USC 112 which should be withdrawn.

In the recent Office Action claims 1-8 were rejected under 35 USC 103(a) as unpatentable over 5,210,453 Nelson in view of 5,433,570 Koppel. Reconsideration and withdrawal of the rejection is requested.

This rejection is supported by the assertion that the Nelson electrical AC generator in FIG. 3 includes "a corresponding plurality of circumferentially spaced ears (13) having threaded apertures...to bolt the housing ends together against the stator with a through-bolt (18) comprising a head portion (44) end, an elongated shank portion (c) and a threaded portion (42) extending from the elongated shank portion whereby the through-bolt is subject to bending stress."

However, the statement that the through-bolt is subject to bending stress is neither made nor suggested by Nelson. Neither is there any suggestion that Nelson's bolts were subject to failure in the prior arrangement shown in FIG. 1 or in the modified arrangement illustrated in FIGS. 3 and 4. Instead the Nelson patent is directed solely to overcoming a problem of excessive noise from the vibration of the bolt head and stem within the openings 19 in and engaging the ears of the member 116 in the prior art arrangement of FIG. 1.

Closer study of the reference shows that there is a large clearance between the shank of the bolt and the outer diameter of the surrounding aperture so that a problem of vibration of the bolt shank and head existed which caused an unsatisfactory noise to exist from sliding of the bolt head on the surface of the member 16 or 116 in FIG. 1. This was cured by putting in the chamfer 21 to hold the bolt head from vibrating but

there is no suggestion in the reference that this change caused any problem of bending stress or fatigue failure in the bolt.

The secondary Koppel reference allegedly shows a necked down portion adjacent to the threaded portion of the shank "wherein the diameter is sufficiently less than a minor diameter of the threads in the threaded portion of the shank" for withstanding forces acting on the head of the screw "making it fatigue resistant". However the teaching of Koppel is that the necked down portion of the shank should not have a diameter less than a minor diameter of the threads (see column 2, lines 14-26.) Koppel also teaches that the groove or grooves must be made by material removal rather than by rolling because the rolled region would be too strong to relieve the bending load (see column 2, lines 1-13).

However, applicants' bolts have the necked down portion formed by rolling and made with a diameter less than a minor diameter of the threads in the threaded portion of the shank. This is directly opposite to the teaching of Koppel.

In addition, Koppel never suggests that his problem of a bending load results in a fatigue failure, but merely that "alternating bending in the region of the thread leads to crack formation in the threaded core after a corresponding number of alternating motions" (see column 1, lines 33-40.) Since the bending load of the Koppel screws is apparently quite extreme and probably occurs only at a rate of one cycle a day because of heating and cooling of the roof attachment elements, it appears to suggest that bending of the screws may exceed the elastic limit and cause a failure from excessive bending rather than from true fatigue failure which generally requires thousands or millions of cycles to cause a part failure. Nevertheless, even if the disclosure of Koppel is considered to teach a fatigue failure, there is no suggestion in the references which would provide a reason for substituting the screw of Koppel for the screw used by Nelson since there is no reason to believe from the Nelson disclosure that he had a problem of fatigue failure of the bolts or in fact any failure of the bolts.

In view of these facts, there is no basis in the references or motivation for putting the Koppel screw in the Nelson generator and therefore the combination of

references is an improper combination that is not supported by the teachings of the references themselves and thus cannot make obvious the generator arrangement disclosed by applicant. In applicants' case fatigue failures of bolts were shown by testing to exist based upon bending of the bolts by distortion of the ears wherein vibration of the generator housing then resulted in fatigue failures. Since the prior art contains no such teaching or suggestion of such a problem, the art is inadequate to form a basis for finding applicants' invention obvious and therefore the rejection under 35 USC 103(a) has insufficient basis and should be withdrawn.

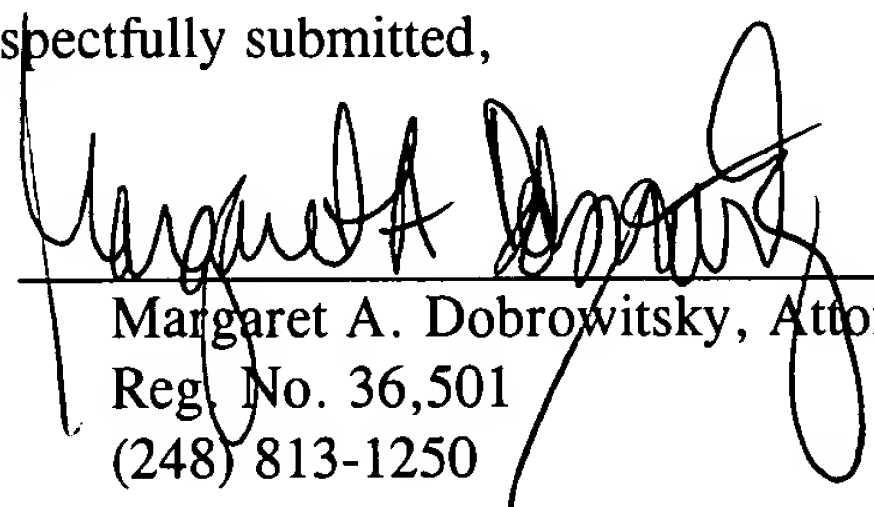
As to claims 4 and 8, the teachings of Koppel, which point out that a rolled groove is stronger than one which is machined, also make it clear that applicants' bolt which is rolled provides different characteristics than the Koppel bolt which is machined, at least as far as the reduced diameter grooves are concerned. Thus the method of manufacturing of applicants' bolts does provide a material difference in the structure of the bolts themselves and thus should be given patentable weight as used in claims 4 and 8, since the products of the two methods of manufacture are in fact different.

For all of these reasons the rejections of claims 1-8 under 35 USC 103(a) are not supported by an adequate basis and should therefore be withdrawn. Allowance of claims 1-8 as now amended is accordingly requested.

This Amendment is believed to be fully responsive to the issues raised in the Office Action and to place this case in condition for allowance. Favorable action is requested.

Respectfully submitted,

By


Margaret A. Dobrowitsky, Attorney
Reg. No. 36,501
(248) 813-1250

AMENDMENTS

Version with markings to show changes made

In The Specification:

Substitute the following for the paragraph beginning on page 2, line 10.

The present invention provides an alternator [thorough] through-bolt that is more resistant to fatigue than conventional alternator through-bolts. The fatigue life of the through-bolt is increased by causing the highest stress to occur away from the threads. This is accomplished by reducing the diameter of the shank of the bolt until the highest stress occurs on the shank. Stresses at the threads are correspondingly lower. The advantage in moving the high stress away from the threads offsets any disadvantage of correspondingly higher stress at the shank of the bolt because there is no appreciable stress concentration factor for the shank (and the concentration factor for rolled threads is about 3). The result of this change to fatigue life is non-linear, which allows improvement of the bolt life by making the shank weaker.

Substitute the following for the paragraph beginning on page 2, line 25.

Accordingly, a through-bolt in accordance with the present invention is for use with an AC generator having a housing including a drive-end portion and a mounting-end portion. A stator is mountable between the drive-end portions. A rotor is mounted for rotation within the housing. One of the end portions includes a plurality of circumferentially spaced ears having first apertures therein and the other end portion includes a corresponding plurality of circumferentially spaced ears having threaded apertures therein. The through-bolt is inserted through one of the first apertures and received in one of the threaded apertures to bolt the housing ends together against the stator. The through-bolt is subject to bending stress since it does not operate on a solid stack up[, regardless of alignment]. The through-bolt comprises a head portion, an

elongated shank portion, and a threaded portion extending from the elongated shank portion. The shank portion is necked-down adjacent the threaded portion to a diameter sufficiently less than a minor diameter of the threads in the threaded portion such that the resistance of the through-bolt to fatigue failure is increased.

Substitute the following for the paragraph beginning on page 4, line 19.

The through-bolt 26 comprises a head portion 32, an elongated shank portion 34, and a threaded portion 36 extending from the elongated shank portion. The shank portion 34 includes a necked-down feature or portion 38 adjacent the threaded portion 36 necked down to a diameter sufficiently less than a minor diameter of thread in the threaded portion 36 to encourage maximum stresses to occur away from the threads. The end portions adjacent ears 22, 28 are deformed during installation by the clamp load of the bolts acting on the overhung or cantilevered outer edges of the end portions. This deformation subjects the through-bolt to bending stress since the bolt does not operate on a solid stack up[, regardless of alignment]. This bending stress can lead to fatigue failure of the bolt due to vibration of the alternator during vehicle operation. However, the necked-down shank portion increases the resistance of the through-bolt to fatigue failure associated with the mechanical stresses imposed on the through-bolt through the bending stresses, engine and generator vibration, the pull associated with the generator drive belt, and the cantilevered disposition of the generator on the engine.

Substitute the following for the paragraph beginning on page 5, line 4.

FIGS. 3-5 illustrate the various embodiments of through-bolt 26 which have been shown to increase the fatigue resistance of the [thorough] through-bolt in use. FIG. 3 illustrates through-bolt 26 having a necked-down feature 38 adjacent the threaded portion 36 of the bolt. FIG. 4 illustrates another embodiment of the through-bolt 40 wherein the elongated shank portion 42 is necked-down at 44 generally from its head

portion 32 to its threaded portion 36. FIG. 5 illustrates yet another embodiment of the through-bolt 46 wherein the shank portion 48 includes two or more spaced necked-down portions 50. Each of these embodiments has been found to provide an increased fatigue failure resistance vis-à-vis a conventional electrical generator through-bolt.

In The Claims:

Amend claims 1 and 5 as follows:

1. (Amended) A through-bolt for use in combination with an electrical AC generator having a housing including a drive-end portion and a mounting-end portion, a stator mountable between said drive-end and mounting-end portions, and a rotor mounted for rotation within said housing, one of said end portions including a plurality of circumferentially spaced ears having first apertures therein and the other of said end portions including a corresponding plurality of circumferentially spaced ears having threaded apertures therein whereby a through-bolt is inserted through one of said first apertures and received in one of said threaded apertures to bolt said housing ends together against said stator, whereby the through-bolt is subject to bending stress since it does not operate on a solid stack up, [regardless of alignment,] said through-bolt comprising:

a head portion;

an elongated shank portion; and

a threaded portion extending from said elongated shank portion;

said shank portion being necked-down adjacent said threaded portion to a diameter sufficiently less than a minor diameter of threads in said threaded portion such that the resistance of said through-bolt to fatigue failure is increased.

5. (Amended) An electrical AC generator having a housing including a drive-end portion and a mounting-end portion, a stator mountable between said drive-end and mounting-end portions, and a rotor mounted for rotation within said housing, one of

said end portions including a plurality of circumferentially spaced ears having first apertures therein and the other of said end portions including a corresponding plurality of circumferentially spaced ears having threaded apertures therein whereby a through-bolt is inserted through one of said first apertures and received in one of said threaded apertures to bolt said housing ends together against said stator, whereby the through-bolt is subject to bending stress since it does not operate on a solid stack up, [regardless of alignment,] said through-bolt comprising:

a head portion;

an elongated shank portion; and

a threaded portion extending from said elongated shank portion;

said shank portion being necked-down adjacent said threaded portion to a diameter sufficiently less than a minor diameter of threads in said threaded portion such that the resistance of said through-bolt to fatigue failure is increased.

In The Abstract:

Substitute the following paragraph for the previous Abstract.

A through-bolt for use with an AC generator has a housing including a drive-end portion and a mounting-end portion. A stator is mountable between the drive-end portions. A rotor is mounted for rotation within the housing. One of the end portions includes a plurality of circumferentially spaced ears having first apertures therein and the other end portion includes a corresponding plurality of circumferentially spaced ears having threaded apertures therein. The through-bolt is inserted through one of the first apertures and received in one of the threaded apertures to bolt the housing ends together against the stator. The through-bolt is subject to bending stress since it does not operate on a solid stack up[, regardless of alignment]. The through-bolt comprises a head portion, an elongated shank portion, and a threaded portion extending from the elongated shank portion. The shank portion is necked-down adjacent the threaded portion to a diameter sufficiently less than a minor diameter of the threads in

U.S. Serial No. 09/977,047 -- 13

the threaded portion such that the resistance of the through-bolt to fatigue failure is increased.